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Waste Nylon Fiber as Alternate Material for Glass Fiber in GRP Composites

Michael Raj.F[1], Sahaya Elsi.S[2], Bravin Daniel.E[3], Starlin Deva Prince.J[4], Freeda.S[5]
1 Professor, Stella Mary's College of Engineering, Aruthenganvilai, Azhikal Post -629202, Tamil Nadu, India
2 Assistant Professor, University College of Engineering Nagercoil, Tamil Nadu, India
3,4 Assistant Professor, Stella Mary's College of Engineering, Aruthenganvilai, Azhikal Post -629202, Tamil Nadu, India
5 Assistant Professor, Udaya School of Engineering, Vellamodi, Tamil Nadu, India
Corresponding Author E mail;michaelrajf@yahoo.com

Abstract

Environment is influenced and polluted by non-biodegradable materials. In marine engineering applications glass fiber are mostly used because of low cast and easy availability. Glass fiber is a non-biodegradable and involves high risk during processing. Nylon fiber is tough, having high tensile strength &elasticity and lustre. They are highly resistant to abrasion and chemicals. In this study, waste nylon fibers are substituted for glass fibers in polyester matrix. Mechanical properties such as tensile, impact and flexural are studied according to ASTM standards. The reuse of waste nylon fiber as alternate source of glass fiber for manufacturing the composites minimise the problem of waste disposal.

Keywords: *Nylon fiber, composites, mechanical properties*

I. INTRODUCTION

Composite materials have long life, higher strength, lower weight and less maintenance. These properties have led to many engineering applications, particularly transport sector. Composite utility significantly reduce energy consumption and subsequent impact to the environment. Natural fiber composites are likely to be environmentally superior to glass fiber composites. Natural fibers offer various advantages such as low cost, low density, acceptable specific properties, biodegradability, better insulating and thermal properties, renewable and environmentally friendly. These properties drive the igh demand for this material [1–3]. The use of natural fiber composites for certain engineering applications fails because certain characteristics cannot meet the requirements for specific engineering application [4]. Hence, specific materials should be used to meet certain specifications for specific applications.

In recent years, numerous research have been carried out to develop environment friendly composites with desirable properties. Nylon fibers are usually made of artificial polyamides like nylon. In India about 7000-8000 metric tons of solid waste of nylon 6 is generated every year [5]. An integrated waste management system has to be planned in order to effectively use, recycle and dispose of polymer materials [6].

Modern plastics can last up to 600 years in the marine environment, depending upon water conditions, ultraviolet light penetration and the level of physical abrasion. The high accumulation potential suggests that micro plastics could be a potential source of toxic chemicals in the environment [7]. Salmon gill nets can be re-processed to manufacture new products like wheels for chairs, tool handles, auto parts, telephones, computer parts, toothbrushes, upholstery, and carpeting [8].

The present work is focused on the use waste nylon fiber as alternate material of glass fiber when partially incorporated with polyester matrix in GRP composite.

II. MATERIALS AND METHODS

Waste nylon fiber, Glass fibers, Polyester resin and hardener obtained from Ciba Gugye Limited were used for this study. This has a viscosity of 10 Poise at 250°C. The composites were developed by using hand layup technique. The specimen size is 30x30 cm.

III. RESULTS AND DISCUSSION

A. Tensile test

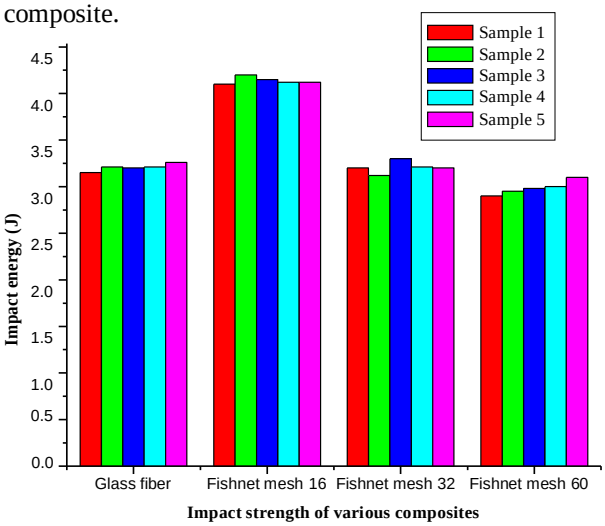
Tensile strength at yield and at break of composites was measured by using a Universal Testing Machine. This test was conducted as per the ASTM D 638 specifications. The tensile strength of glass fiber composite is more as compared to waste nylon fiber composites. The study reveals that the elastic modulus of waste nylon fiber incorporated composites and glass fiber composites are found to be close enough.

B. Flexural test

The flexural tests are performed according to ASTM D 790 using Universal Testing Machine at a cross head speed of 5 mm/min. Test specimens were cut to 191×13 mm. The flexural modulus and strength of waste nylon fiber incorporated composites is found to be more when compared to glass fiber composites.

C. Impact test

Impact test carried out on composite specimens cut from fabricated plates in accordance with ASTM D 3029. Specimen is fixed in slot and impact load is applied, by releasing pendulum. Load required to break specimen is noted down and procedures is repeated for different trials. A minimum of five specimens are tested in each group of the composite.



The impact strength of glass fiber is less when compared to waste nylon fiber composites. However, nylon materials are have more elastic property which aid the composite to withstand more impact load when compared to glass fiber composites.

IV. CONCLUSIONS

The study reveals the fact that the waste nylon fibers can be used as a partial substitute for glass fiber composites. The impact resistance, flexural properties of the waste nylon fiber composites is appreciably higher than the glass fiber composites. Hence waste nylon fiber substitute composites can be used as an alternative for glass fiber composites. Therefore utilization of nylon fiber in composites manufacturing not only gives value added product but also helps in the problem of waste disposal.

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